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Longitudinal comparisons of self-affirmation approaches for sun protection

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Abstract

Objectives: Self-affirmation approaches for health behaviour demonstrate consistent small to medium effects on message acceptance, health intentions and behaviour change. There are several forms of self-affirmation (e.g., values affirmations, implementation intentions), but few empirical comparisons to guide selection in empirical work. Further, there has been little emphasis on the putative mechanisms of self-affirmation driving behaviour change. The current investigation compared a control and four self-affirmation approaches: values, social, implementation intention, and perspective taking.

Methods: Participants were recruited through CloudResearch ($N = 666$) and reported baseline sun exposure and protection behaviour at Time 1. One week later (Time 2), returning participants ($N = 535$) were randomly assigned to condition, viewed a message conveying risks of sun exposure, and reported sun exposure and protection intentions for the next week. Follow-up one week later (Time 3; $N = 449$) assessed past week sun exposure (i.e., number of days spent outside during peak hours), sun protection behaviour (e.g., sunscreen use), future sun exposure and protection intentions and engagement with resources conveying further health information (i.e., viewing infographics, following links to websites with more information). The association of putative mechanisms with self-affirmation conditions and health outcomes was also examined.

Results: Unexpectedly, there were few differences between self-affirmation conditions and the control on intentions, information seeking, or behaviour at follow-up. At follow-up, perspective circle participants reported fewer days spent outside, spent longer viewing infographics, and,

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AUTHOR CONTRIBUTIONS

Bethany Shorey Fennell: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; visualization; writing – original draft; writing – review and editing. **Renee E. Magnan:** Conceptualization; methodology; supervision; writing – review and editing. **Robin L. Hunt:** Data curation; investigation; writing – review and editing.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

OPEN RESEARCH BADGES

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SUPPORTING INFORMATION

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along with social values participants, followed more weblinks seeking information than control participants. The putative mechanisms were unrelated to health outcomes.

Conclusions: The current investigation was a first step in comparing novel online self-affirmation approaches and had largely null findings. Results suggest that the perspective circle performed best at promoting information seeking and, to some extent, behaviour change. Suggestions for future directions are discussed.

Keywords

health intervention; self-affirmation; sun protection

INTRODUCTION

The majority of skin cancer cases worldwide are preventable by engagement in daily protective behaviours that reduce exposure to ultraviolet radiation (UVR; Arnold et al., 2018; Olsen et al., 2015) such as limiting midday time in the sun, seeking shade, wearing protective clothing and using sunscreen (WHO, 2022). Knowledge of sun-related health risks is widespread (Hay et al., 2009), yet rates of unprotected sun exposure remain high with 6%–21% of men and 22%–35% of women reporting regular sunscreen use (Olsen et al., 2018). Approaches to modify sun protection behaviour are often unsuccessful (Goulart & Wang, 2010; Guile & Nicholson, 2004) emphasizing the need for continued empirical work to motivate sun protective behaviours. One promising approach may be self-affirmation.

Self-affirmation is the desire to view oneself as “adaptive and morally adequate” (Steele, 1988, p. 262). When this view is threatened, for example, by a message advocating health change, it can challenge perceived competence (e.g., making good health decisions) or coherence (e.g., being a healthy person). Self-affirmation approaches restore self-regard and enable engagement with a threat in a productive, rather than avoidant, manner (e.g., more accurately assessing risk, Harris & Napper, 2005). Self-affirmations increase message acceptance and behaviour change across multiple health behaviours (Ferrer & Cohen, 2018), and meta-analyses demonstrate small to moderate effect sizes on health intentions ($d = .14$ – $.26$) and behaviour ($d = .27$ – $.32$; Epton et al., 2015; Sweeney & Moyer, 2015). Regarding sun protection specifically, self-affirmation shows some efficacy for increasing protective cognitions and behaviours including stronger positive attitudes toward sunscreen and taking free samples of sunscreen (Jessop et al., 2009), greater message acceptance for UV-related photoaging (Good & Abraham, 2011), stronger intentions for sun protection behaviours (Hagerman et al., 2020), and less self-reported sun exposure (Schüz et al., 2013).

Self-affirmation approaches

Various self-affirmation approaches exist (Cohen & Sherman, 2014). The most common is the values affirmation essay (Epton et al., 2015) in which individuals write an essay about why a top value is personally important, often after ranking the importance of six to ten commonly held values (e.g., friends and family; Cohen & Sherman, 2014). Modifications of the values approach include writing an essay on how the top value fosters social

connectedness (e.g., Shnabel et al., 2013) or reflection on one value only (e.g., kindness; Jessop et al., 2009). Values affirmations are often used to promote health behaviour change (Cohen & Sherman, 2014), accounting for approximately 90% of self-affirmation manipulations (Epton et al., 2015).

Training self-affirmation in preparation for encountering threats is occasionally used via implementation intentions, or “if-then” goals. Individuals view a prompt (e.g., “If I feel threatened or anxious, I will...”) and pick an affirming statement to complete the sentence (e.g., “...think about my values”; Armitage & Arden, 2016). These have been successful alone (e.g., Armitage et al., 2011; Ehret & Sherman, 2018) or in combination with other affirmation techniques (e.g., Harris et al., 2014; Norman & Wrona-Clarke, 2016).

A final strategy, although relatively rare, is to broaden perspective (Critcher & Dunning, 2015; Crocker et al., 2008; Lindsay & Creswell, 2014). Experiencing a threat can narrow one’s perspective to focus on mitigating the threat. Self-affirmation enables one to “zoom out” and take a broader view (Sherman et al., 2013). For example, Critcher and Dunning (2015) had college students rate a list of values then visually represent the importance of their highest value, lowest value, and student identity (the threatened identity) to their sense of self. This perspective-taking exercise and a standard values affirmation similarly reduced defensiveness relative to a control.

Although reviews suggest self-affirmations should be similarly efficacious (Epton et al., 2015; McQueen & Klein, 2006), some intervention comparisons are limited because a self-threat was not present, a tenet of Steele’s original theory (e.g., Armitage & Rowe, 2011; Crocker et al., 2008). Among those that include a threat, outcomes are inconclusive. For example, regarding self-affirmation approaches to reduce drinking, evidence variably suggests they work similarly well (e.g., Armitage et al., 2011), do not work well at all (Knight & Norman, 2016), or that some approaches are better than others (Norman & Wrona-Clarke, 2016). Table 1 presents examples of self-affirmation comparisons and outcomes. Overall, there is no consensus on best practices for self-affirmation choice.

Self-affirmation mechanisms

The extant literature demonstrates limited empirical support for theoretically based putative mechanisms of self-affirmation approaches that may explain effects on intentions and behaviour. As stated earlier, the goal of self-affirmation is to maintain a sense of self-regard, or *momentary self-worth*, in the face of threats (e.g., strong health messages; Sherman & Cohen, 2006; Steele, 1988). Defensiveness (e.g., reactance) indicates natural self-affirmation at work to bolster feelings of self-worth (Steele, 1988) and can lead to counterproductive health behaviour (i.e., boomerang effects; Shorey-Fennell & Magnan, 2019). However, if other means of self-affirmation are available, global perceptions of self-worth can be maintained, reducing denial and rationalization (Cohen & Sherman, 2014). Experimental work demonstrates that broadened self-perspective mediates the effect of affirmation on defensiveness (Critcher & Dunning, 2015). *Self-esteem* indicates broad and stable self-assessment, while *narrow self-assessment* is related to domain-specific competence or coherence (e.g., health). Critcher and Dunning (2015) found momentary self-worth was related to performance in the threatened domain (narrow self-assessment) for unaffirmed

individuals, leading to more defensiveness. Affirmed individuals' self-worth was related to global self-esteem, and they responded less defensively. Thus, we reason that defensiveness and self-perspective-related constructs are important to investigate as putative mechanisms of self-affirmation (i.e., may be responsible for observed behaviour change; Riddle, 2015).

Empirical work regarding these putative mechanisms largely indicates self-affirmation leads to a broadened perspective (Armitage et al., 2011; Crocker et al., 2008; Kamboj et al., 2016; Lindsay & Creswell, 2014). However, the effect of self-affirmation on defensiveness is mixed: some studies find reductions in defensiveness after self-affirmation (e.g., Armitage et al., 2011) while others demonstrate no effect (e.g., Knight & Norman, 2016). To date, little work has addressed whether various self-affirmation approaches are influencing the same putative mechanisms. This is an important step to determine possible explanations of behaviour change due to self-affirmation, which could lead to more impactful intervention development (Zhu & Yzer, 2021).

The current investigation

Often, little rationale is given for the selection of a self-affirmation approach. The current study compares a range of self-affirmation approaches for sun protection to offer practical guidance on selection. We identified approaches based on prior evidence of efficacy and to represent a range of distinctive self-affirmation approaches, including reflecting on personal or social values, perspective taking, and implementation intentions. We followed Ferrer and Cohen's (2018) Trigger and Channel framework for guidelines on the implementation of self-affirmation health interventions. First, a threat must activate self-affirmation processes (Steele, 1988). Second, the intervention should occur before threat exposure. If self-affirmation occurs after the threat, individuals will likely distance themselves from the threat through other methods (Briñol et al., 2007; Critcher et al., 2010). Third, interventions should offer resources to facilitate behaviour change (e.g., quit lines). Self-affirmation may not be the vehicle of behaviour change, but may increase receptivity (i.e., be the trigger) to accept or apply information in new ways (i.e., the channel).

The primary aim of the study was to determine efficacy of four self-affirmation approaches versus a control on intentions to engage in sun protective behaviours, engagement with resources, and sun protective behaviours (e.g., wearing sunscreen) after viewing a health message about sun protection. We hypothesized that (H1) intentions to engage in sun protective behaviours, engagement with resources, and sun protective behaviours would be higher for those in each of the self-affirmation conditions compared to the control. Further, we compared the most commonly used and validated technique, the values affirmation, to all other approaches. We did not have a priori expectations regarding whether the values self-affirmation would differ from others.

A secondary aim was to test theoretically relevant putative mechanisms of self-affirmation interventions with the goal of providing evidence that self-affirmation modifies these mechanisms. This could be helpful to guide selection of potential mechanisms for future formal tests of indirect effects on behaviour change. We examined putative mechanisms indicating (1) a broadened perspective (self-esteem, positive and negative momentary self-worth, and narrow (health-specific) self-assessment) and (2) defensiveness (here measured

as reactance). We hypothesized that (H2a) Momentary self-worth assessments would be more positive and less negative for self-affirmation versus control participants, (H2b) Momentary self-worth assessments for participants in the control condition would be related to narrow (health) self-assessment, but not broad self-esteem, and the inverse true for self-affirmed participants, and (H2c) Defensiveness would be lower for participants in the self-affirmation conditions versus the control. There was not a specific hypothesis regarding differences between self-affirmation interventions on scores of self-worth or defensiveness.

Planned sample size, manipulations, hypotheses, and analyses were pre-registered prior to completion of data collection and before any analyses were conducted (Open Science Framework Registration DOI: [10.7605/OSF.IO/YVC4M](https://doi.org/10.7605/OSF.IO/YVC4M)). Deviations from the pre-registration are noted below.

METHOD

Participants and procedure

The study was a repeated measures between subjects design with five conditions: four self-affirmation conditions (personal values, social values, perspective circle and implementation intention) and a control. The study had three time points, each approximately 1 week apart. Using G*Power 3.1 (Faul et al., 2009), with an expected small-medium effect ($f = .17$), .80 power, and alpha of .05, 420 participants ($n = 84$ per condition) were needed at Time 3 to detect differences across the five experimental conditions. During February 2019, we conducted a pilot study with an independent sample ($N = 183$) to ensure the message used in the current investigation elicited sufficient threat. The selected message was rated as significantly more threatening than messages rated low threat (Cohen's $d = 1.04$) and similarly or more threatening compared to messages that demonstrated high threat in previous experimental work (Shorey-Fennell & Magnan, 2019). Details on the message and selection procedures are available in the OSF study record. During October 2019, 666 U.S. adults aged 18 and older were recruited through CloudResearch, an online research panel, and directed to Qualtrics, the hosting platform, where they gave informed consent and completed the baseline assessments of sun exposure, sun protective behaviours and demographics. One week later (Time 2) 535/666 participants returned (80.3%) and were randomly assigned to a condition. After completing the assigned self-affirmation or control task, they viewed a graphic message depicting consequences of sun exposure and advocating sunscreen use. They then indicated their intentions to use sun protection over the next week and completed measures of putative mechanisms of self-affirmation. Following Trigger and Channel guidelines, we provided resources in the form of infographics with additional information about sun protection. Participants who exited the study before completing the assigned self-affirmation or control task, and therefore completed less than 50% of T2, were excluded from subsequent analyses ($N = 44$). Thus, 73.7% ($N = 491$) of Time 1 participants were included in Time 2 analyses and recontacted for Time 3, 1 week after Time 2. At Time 3 ($N = 449$; 67.4%), participants reported their past-week sun protective behaviour and intentions to engage in sun protection over the next week. They were again shown infographics and provided links to websites with information about sun-related skin damage and cancer, self-screening for skin abnormalities, and sun protection techniques.

Engagement with these resources (i.e., following a link) indicated a participant was seeking out information. Figure 1 shows retention through the study. The message and message selection procedures, condition details, including exact wording for all self-affirmation and control approaches, condition fidelity, and provided resources are available in the OSF study record. All the procedures were approved by the Washington State University IRB.

Experimental approaches

Personal values—Participants ranked a set list of 10 values (friends and family, religion, politics, science, cultural values (Cohen et al., 2000), personal appearance, intelligence, sports, art, humour), then wrote a short essay (3–7 min) about why their top value among the presented options was important to them. This list reflects options commonly used in prior self-affirmation work (Cohen & Sherman, 2014) and includes “cultural values” based on evidence this it also induces self-affirmation (Sherman et al., 2013).

Social values—Procedures were identical to the personal values affirmation with the exception that participants wrote an essay about how their most important value makes them feel closer and more connected to others, following procedures by Shnabel et al. (2013).

Implementation intention—Participants saw the beginning of an action plan (“When I feel threatened or anxious I will...”) and chose a statement to finish the sentence with one of six options (“think about things I have succeeded in.”; “think about my close relationships.”; “think about my cultural values.”; “think about the things I value in my life.”; “think about things I am looking forward to in the future.”; “think about what I stand for.”). The response choices were modified to include social, cultural, and future-oriented options (Armitage et al., 2011; Cascio et al., 2016; Sherman et al., 2013).

Perspective circle—Participants ranked the same list of values as the personal values affirmation, then viewed a demarcated pie chart with 16 discreet sections and were instructed: “For this exercise imagine the pie chart represents who you are as a person. A person’s identity is made up of many facets, and the wedges represent the relative importance of different pieces of your identity”. Participants marked sections to indicate the relative importance of their most and least important values and their health. These three identity facets did not need to fill the whole chart. Examples can be found in the OSF study record. The manipulation was modified for online (vs. pen and paper) administration and to focus on health, instead of “student identity” as was done in Critcher and Dunning (2015).

Control—Participants wrote an essay on how to charge a cell phone. This control condition was designed to be an equivalent control to each self-affirmation condition and to be non-self-referential, as self-reflective control tasks may induce self-affirmation (Cascio et al., 2016; Cohen et al., 2000). Procedures were modified from Cascio et al. (2016), who had participants in an fMRI think about charging a cell phone.

Measures

Sun exposure—At Time 1 and Time 3, participants reported the number of days in the past week they were outside between peak exposure hours of 10 AM and 4 PM (0–7).

Past week sun protective behaviour was assessed with two items: “Of the days you were outside, during how many did you wear sunscreen?”, “Of the days you were outside, during how many did you wear protective clothing, such as a hat or a shirt with sleeves?” (0–7). Unprotected sun exposure was calculated by subtracting the number of days of any reported sun protection from the total number of sun exposure days (range –7 to +7; Hillhouse et al., 2012).

Sun exposure intentions—At Time 2 and Time 3, participants indicated their sun exposure intentions with one item: “How many days in the next week do you plan to be outside between 10 AM and 4 PM?” (0–7). Sun protective intentions was assessed with three items “How many days in the next week do you plan to wear sunscreen?”, “Of the days you are planning to be outside, during how many do you plan to wear sunscreen [protective clothing, such as a hat or a shirt with sleeves]?” (0–7). Intended unprotected sun exposure was calculated by subtracting the number of days of any intended sun protection from the total number of intended sun exposure days (range –7 to +7; modified Hillhouse et al., 2012).

Resource engagement—At Time 2 and Time 3, participants viewed infographics about sunscreen. Dwell time on the infographic was used as a measure of engagement with resources. At Time 3 participants were also provided with five links to external web-based resources (e.g., American Academy of Dermatology website) with information about sun protection techniques (e.g., how much sunscreen to apply). Following links (0 = *no links*, 1 = *any links*) was as an additional assessment of resource engagement.

Typical sun exposure was assessed with one item at Time 1 and Time 3: “How typical was this week in terms of how many hours you spent in the sun?” (1 = *Not at all*; 7 = *Very*).

Domain importance was assessed with two items at Time 1: “How important is skin health to you?” and “How important is it for you to be tan? (*r*)” (1 = *Not at all*; 7 = *Very*).

Value importance was assessed at Time 2 with one item: “How meaningful is your chosen value to you?” (1 = *Not at all meaningful*, 7 = *Extremely meaningful*, modified Siegel et al., 2005).

Self-esteem—Self-esteem, an indicator of broad self-evaluation at Time 1, was assessed with the 10-item Rosenberg Self-esteem Scale (Rosenberg, 1965). Example items include, “I am able to do things as well as other people” and “I wish I could have more respect for myself (*r*)”, (1 = *Strongly Disagree*, 4 = *Strongly Agree*). Responses were averaged with higher scores representing more self-esteem ($\alpha = .93$).

Momentary self-worth—Positive and negative feelings of self-worth (Critcher & Dunning, 2015) were assessed after viewing the threatening health message (Time 2) with 14 items. Example items include: “I currently feel pleased with myself” and “I am frustrated or rattled” (1 = *Not at all*, 9 = *Extremely*). Responses were averaged with higher scores representing higher feelings of positive or negative self-worth (α positive = .96; α negative = .93).

Narrow self-assessment—Narrow self-assessment (health domain) was measured with one item at Time 2: “I feel I am pretty good at making healthy decisions for myself” ($1 = \text{Not at all}$, $9 = \text{Extremely}$; modified Critcher & Dunning, 2015).

Defensiveness—Defensiveness was assessed with the Reactance to Health Warnings Scale (Hall et al., 2017) at Time 2, “This warning is trying to manipulate me”, “The health effect on this warning is overblown”, “This warning annoys me”; ($1 = \text{Strongly Disagree}$ / $5 = \text{Strong Agree}$). Responses were averaged with higher scores representing more defensiveness ($\alpha = .83$).

Analyses

Continuous variables were normally distributed. Preliminary ANOVAs determined equivalence of groups on demographics, sun exposure, sun protection, sun exposure typicality, value/domain importance and condition duration. Baseline characteristics did not differ by condition suggesting randomization was successful (see Table 2). Time 1 sun exposure was entered as a covariate to account for within-person variation in sun exposure; no other covariates were entered into the models. We used an intent-to-treat approach in which participants who completed a condition were not excluded from the main analyses based on compliance with instructions (Ranganathan et al., 2016). Per-protocol analyses did not change interpretation of outcomes. One-way ANOVAs compared the control to the four self-affirmation conditions on intentions (Time 2, Time 3), resource engagement (Time 2, Time 3), and days outside and unprotected sun exposure (Time 3). Planned comparisons examined differences between each condition and the control (referent condition), even in the absence of a significant omnibus test as recommended when specific comparisons are the outcomes of interest (Games, 1971; Hancock & Klockars, 1996; Howell, 2010). Binary logistic regression examined whether individuals followed links for additional information at Time 3. Logistic model evaluation was conducted with Likelihood ratio and Score tests and specific conditions were compared to the referent condition with Wald’s chi-square tests (Menard, 1995; Peng et al., 2002). The same procedures were used to examine differences between the self-affirmation conditions using the values affirmation as the referent condition. Examining these comparisons was the only change from the preregistration procedures.

One-way ANOVAs also compared the control to the self-affirmation conditions on defensiveness, self-worth and narrow self-assessment. Planned comparisons examined differences between the control and each of the four experimental conditions on these outcomes. Follow-up Tukey’s post hoc tests explored differences across the four self-affirmation conditions for significant omnibus tests. Multiple regression examined how narrow self-assessment related to self-worth post message exposure for control versus self-affirmation participants. Specifically, we evaluated the interaction of intervention (Control vs. All self-affirmations) X narrow self-assessment on self-worth. Following Critcher and Dunning (2015), baseline self-esteem was controlled for in these analyses.

RESULTS

Participant characteristics

Table 2 presents participant characteristics after condition assignment ($N = 491$). Participants were on average 39.68 years of age ($SD = 11.93$; range 18–73). Approximately half were female (52.4%), and the majority White (74.3%) followed by Black/African American (10.1%), Asian/Asian American (7.0%), Hispanic/Latinx (3.7%), and Mixed race (4.3%). Participants from each U.S. state, Puerto Rico and Washington D.C. were represented. Participants reported their skin health was important to them ($M = 5.89$, $SD = .96$), their last week of sun exposure was fairly typical ($M = 5.37$, $SD = 1.33$), and on average reported not using any form of sun protection (e.g., sunscreen) 1.45 sun exposure days ($SD = 3.05$) in the last week. Participant characteristics did not differ across condition ($ps > .30$).

Participants who were excluded from Time 2 ($N = 44$, exited the study before completing an experimental condition or unable to match) and Time 3 ($N = 42$, did not return or unable to match) were generally younger ($M = 37.60$, $SD = 12.13$, $p = .046$, $d = .18$) than those who were not excluded ($M = 39.72$, $SD = 12.00$). As age was not associated with outcomes of interest ($r = .001$, $p = .09$), unadjusted outcomes are reported. There was no difference by condition in attrition between Time 2 and Time 3 [$\chi^2(4, N = 486) = 1.68$, $p = .79$]. Quality of responses were examined, and no additional participants were excluded for inattention.

Condition characteristics

Condition fidelity—Two authors, BSF and RLH, jointly coded a subsample of approximately 20 cases on condition fidelity according to predetermined rules and independently coded the remainder of the sample. Independent agreement between coders was 100%. Condition fidelity was high across all conditions (83% or better; see the OSF study record for details).

Value importance—Values ($M = 6.69$, $SD = .72$), social ($M = 6.61$, $SD = .74$), and perspective circle participants ($M = 6.66$, $SD = .76$) rated their chosen value as more meaningful than implementation intention participants ($M = 5.88$, $SD = 1.34$; $F(3, 374) = 16.65$, $p < .001$, $\eta_p^2 = .12$).

Condition duration—Average time to completion was less than 5 min and differed by condition [$F(4, 472) = 23.16$, $p < .001$, $\eta_p^2 = .22$]. The social ($M = 4.99$ min, $SD = 2.23$) and values affirmations ($M = 4.74$, $SD = 2.90$) took the most time, followed by the control ($M = 3.65$, $SD = 2.19$) and implementation intention conditions ($M = 3.50$, $SD = 1.99$), and the perspective circle condition took the least time ($M = 2.55$, $SD = 1.50$).

Control versus self-affirmation conditions

Time 2 intentions and resource engagement—There were no significant main effects for unprotected sun exposure intentions [$F(4, 490) = 1.38$, $p = .24$, $\eta_p^2 = .012$] or time spent viewing the infographic [$F(4, 490) = .53$, $p = .71$, $\eta_p^2 = .005$] between self-affirmation conditions and the control immediately after viewing the health message,

and no self-affirmation condition differed from the control on these outcomes in planned comparisons ($ps > .07$). Table 3 presents means and effect sizes across conditions.

Time 3 behaviour, intentions, and resource engagement—Controlling for Time 1 sun exposure, there was not a significant effect of condition on past week days outside [$F(4, 432) = 1.75, p = .14, \eta_p^2 = .016$]. However, planned comparisons revealed that participants in the perspective circle condition reported fewer days of sun exposure ($M = 3.30, SD = 1.98$) compared with the control condition ($M = 4.02, SD = 2.11; p = .02, d = .35$). There was not a significant effect of condition on past week unprotected sun exposure [$F(4, 432) = 1.01, p = .40, \eta_p^2 = .009$] and no self-affirmation condition significantly differed from the control on these outcomes in planned comparisons ($ps > .13$). Additionally, there was no effect of condition for sun exposure or protection intentions [$F(4, 432) = .42, p = .80, \eta_p^2 = .004$], nor did any differences emerge between self-affirmation conditions and the control in planned comparisons ($ps > .11$).

There was not a significant overall effect of time viewing infographic resources at follow-up [$F(4, 432) = 1.84, p = .12, \eta_p^2 = .017$]. Planned comparisons revealed that participants in the perspective circle condition spent significantly more time looking at infographics (M seconds = 64.84, $SD = 80.72$) than in the control condition ($M = 45.33, SD = 34.57; p = .02, d = .31$). Finally, compared to the control condition (2.3%), participants were more likely to seek additional information (i.e., follow web links) in the perspective circle (17.4%; $OR = 8.98; p = .004$) and social values (13.5%; $OR = 6.62; p = .02$) conditions. See Table 4 for full logistic regression results.

Values affirmation versus all other self-affirmation conditions

Self-affirmation conditions did not significantly differ on engagement with resources, intentions to engage in sun protective behaviours, or follow-up sun protective behaviours immediately after viewing a message at Time 2 or Time 3 ($ps > .11$). Planned comparisons revealed no significant differences between self-affirmation techniques on these outcomes ($ps > .14$; see Table 3).

Putative mechanisms

Table 5 presents means and effect sizes by condition for putative mechanisms and Table 6 presents correlations between putative mechanisms and health outcomes. Putative mechanisms were strongly correlated with one another and weakly correlated with intentions and behaviour.

Positive and negative momentary self-worth—There was a significant difference by condition for negative self-worth [$F(4, 467) = 2.58, p = .04, \eta_p^2 = .02$]. Compared to the control condition ($M = 3.43, SD = 2.05$), participants in the values affirmation ($M = 2.59, SD = 1.94; p = .003, d = .42$), social specific ($M = 2.88, SD = 1.65; p = .049, d = .30$), and perspective circle conditions ($M = 2.82, SD = 1.77; p = .03, d = .31$) reported lower negative self-worth. Tukey's post hoc tests revealed no differences between self-affirmation conditions on negative self-worth ($ps > .33$). There was not an overall significant effect for positive self-worth [$F(4, 467) = 2.35, p = .059, \eta_p^2 = .02$]. However, planned comparisons

revealed that participants in the values affirmation condition reported more positive self-worth ($M = 6.63$, $SD = 1.84$) than those in the control condition ($M = 5.93$, $SD = 1.97$; $p = .07$, $d = .37$).

Narrow self-assessment—There was a significant difference by condition for narrow self-assessment [$F(4, 467) = 2.52$, $p = .04$, $\eta_p^2 = .02$]. Compared to the control ($M = 6.48$, $SD = 2.06$), participants in the values affirmation condition felt they were better at making health decisions for themselves ($M = 7.24$, $SD = 1.67$; $p = .003$, $d = .41$). Tukey's post hoc tests revealed no differences between self-affirmation conditions on narrow self-assessment ($ps > .37$).

Interaction—When controlling for baseline self-esteem, there were no significant interactive effects between condition and narrow (health) self-assessment on positive self-worth ($B = -.06$, $p = .40$) or negative self-worth ($B = -.02$, $p = .86$).

Defensiveness—There was not an overall difference by condition on defensiveness after viewing the message [$F(4, 467) = .02$, $p = .99$, $\eta_p^2 = .00$], nor did the control condition significantly differ from any of the self-affirmation conditions on defensiveness ($ps > .62$).

DISCUSSION

The current investigation compared four self-affirmation approaches and a control task in a sun protection messaging paradigm and had largely null findings. In contrast to expectations, there were no differences in sun exposure intentions for those in the self-affirmation versus control conditions. This is unexpected, as each of the self-affirmation approaches have demonstrated efficacy in relatively brief time frames and the values affirmation particularly has shown some efficacy in online administration (Kamboj et al., 2016; van Koningsbruggen & Das, 2009). Only one behavioural effect emerged: those in the perspective circle condition spent fewer days outside in the following week than those in the control condition. Participants in the perspective circle and social values conditions were more likely to seek additional information (i.e., follow web links) relative to the control condition and those in the perspective circle also spent more time viewing sun protection infographics. Thus, of the approaches tested, the perspective circle self-affirmation demonstrated an advantage. Participants in all three value-ranking affirmations rated their top value as very important (>6.60 out of 7), but only the perspective circle prompted participants to assess the importance of their highest value, lowest value, and health, rather than a single self-aspect. Thinking about multiple self-domains may trigger a broader self-construal (Critcher & Dunning, 2015; Schmeichel & Vohs, 2009) which can in turn guide goal-directed behaviour (McConnell et al., 2012).

One explanation for the weak influence of self-affirmation on intentions and behaviour is that the threat may not have been focused enough, both in terms of the time of year when data were collected and the level of perceived threat (i.e., failure of manipulation). Although we aimed to follow the Trigger and Channel framework by ensuring the self-affirmation manipulations were timely in relation to the threat (Ferrer & Cohen, 2018), it is possible that people were less conscious of sun exposure in mid-autumn. Negative consequences of

sun exposure may be more salient and threatening in the warmer, summer months (Salvado et al., 2021). We also did not recruit on the basis of sun exposure risk. Self-affirmations may be more efficacious when targeting high-risk individuals (Schüz et al., 2013; Sweeney & Moyer, 2015) although interventions targeting high-risk individuals can also backfire (Mays & Zhao, 2016; Taber et al., 2019). Therefore, it is possible that the level of threat may not have been sufficient to elicit a self-affirmation response. We made several efforts to reduce this possibility. First, we conducted an independent study in which the message used in the current study was rated higher on perceived threat than 24 other messages. This study was conducted in winter (February) and, thus, we would not expect the message to be less threatening in the autumn. Additionally, we assessed the importance of the threatened domain of participants' chosen values (Cohen & Sherman, 2014; Steele, 1988). On average, participants in all conditions indicated both skin health and their chosen value was highly important (5.89 and 6.46, respectively, on a 1–7 scale). Participants were objectively higher risk – at baseline 66% reported not using sunscreen on any days they were outside in the past week. Finally, we coded fidelity to the self-affirmation conditions which exceeded 83% for all conditions, providing evidence that the manipulations induced self-affirmation as intended. Despite these efforts, we did not assess whether participants felt the message was *personally* relevant and, thus, cannot definitively determine whether the message was sufficiently threatening to activate the self-affirmation process. Because a secondary aim was to test theoretically relevant putative mechanisms of self-affirmation, it was necessary to focus on the immediate impact on these mechanisms, thus we chose to rely on threat response to the pilot messages rather than assess personal threat. It is also possible that the duration of time on the task (less than 5 min) was not long enough to induce affirmation processes; however, to our knowledge, there is not work to inform ideal self-affirmation duration. Another possibility is that this study demonstrates a true negligible effect of the tested self-affirmation approaches in this context and/or population (i.e., failure of impact). Recent replications of seminal self-affirmation studies in educational contexts suggest the strength of self-affirmation for long-term change may be overstated (Hanselman et al., 2017; Serra-Garcia et al., 2020) and the literature on self-affirmation efficacy for changing health behaviour is mixed (see Table 1).

The current investigation also explored several theoretically based putative mechanisms for self-affirmation on intentions and behaviour. Participants in the values affirmation intervention reported higher positive self-worth, lower negative self-worth, and felt they were better at making healthy decisions than control participants. Those who completed the social and perspective circle affirmations also reported lower negative self-worth. In contrast to prior work (Critcher & Dunning, 2015), we did not find interactive effects between condition and narrow health assessment on momentary self-worth. Although these putative mechanisms are theoretically based, have previously been associated with self-affirmation, and are equally applicable to each self-affirmation approach tested, they were not associated with any health outcomes of interest (Table 6). It may be that these constructs are associated with self-affirmation but are not responsible for the action of self-affirmation on behaviour. Consistent with the Experimental Medicine Approach (Riddle, 2015) in which mechanisms of action are targeted to enact behaviour change, future investigations should prioritize identifying valid mechanisms of self-affirmation. For example, other possible mechanisms

of self-affirmation have been proposed but not tested across affirmation approaches, such as self-compassion (Lindsay & Creswell, 2014) and increased self-resources (Gu et al., 2016; Pietersma & Dijkstra, 2012). Better understanding of mechanisms could inform refinement of both self-affirmation theory and future intervention approaches to promote long-term behaviour change (Rothman & Sheeran, 2020).

Strengths & limitations

The current investigation had a number of strengths. First, we strove to follow Ferrer and Cohen's (2018) guidelines for implementing self-affirmation interventions. The investigation also included assessments of both proximal and longitudinal outcomes, including nuanced assessments of change such as information seeking. To our knowledge, this is the first investigation to compare self-affirmation approaches for sun protection online. The reach of self-affirmation has been limited by traditional delivery methods which are typically in-person (Epton et al., 2015; Ferrer & Cohen, 2018; Springer et al., 2018) and may limit exposure to the broader population (Cohen & Sherman, 2014; Taber et al., 2019). Online interventions reach large numbers of people with greater flexibility and lower costs than traditional health interventions (Muñoz et al., 2016). Although this was a convenience sample, it was diverse in terms of gender, age, race/ethnicity, and geographic distribution within the U.S. There was good engagement with all tested self-affirmations, suggesting their feasibility for online-delivered implementation, and findings indicate the briefest intervention which required no writing, the perspective circle, encouraged the most information seeking and behaviour change.

The current study also had a number of limitations. First, data collection errors resulted in participants being lost between Time 1 (baseline) and Time 2 (intervention). However, they did not differ substantially from those retained. Second, the brief one-week follow-up limits the ability to capture variability in behaviour and to draw conclusions about longer-term outcomes. Particularly for health behaviours, it may take time and several steps (acquiring the sunscreen) before the desired behaviour change is implemented (wearing the sunscreen). Third, although UVR exposure is a daily cumulative risk (Godar et al., 2003) and sun protection behaviour is appropriate year-round, the risks of sun exposure may be less salient in October (mid-autumn in the Northern Hemisphere) than warmer times of the year. Thus, comparison of self-affirmation approaches for sun protection should be replicated during summer when sun exposure is more salient. Finally, we did not assess *personal* relevance of the message and, thus, cannot speak to whether the message ultimately elicited enough threat to activate the self-affirmation process. The relationship between objective risk, perceived risk, and self-affirmation is complex. For example, self-affirmation may be effective for promoting health behaviours among objectively high-risk individuals who are unrealistically optimistic about their health risks, but backfire among individuals whose perceived risk matches or exceeds their actual risk (Klein et al., 2010). This complexity should be carefully considered in future work.

CONCLUSIONS

The aim of the current investigation was to compare the efficacy of four online self-affirmation approaches and offer practical guidance on selection to inform future self-affirmation work. Overall, there were few differences between self-affirmation and control approaches a on sun exposure and protection intentions, behaviour, and information seeking. At follow-up, compared to those in the control condition, participants in the perspective circle affirmation condition reported fewer days of sun exposure in the past week, spent more time viewing infographics, and, along with those in the social affirmation condition, followed more links to further information. Additionally, this approach was the briefest tested, prompted consideration of multiple self-aspects, and did not require reflective writing which may make it particularly well-suited for online intervention. It might be tempting to conclude that this work supports that most self-affirmation approaches are equivalent. This conclusion is likely premature given the limited work comparing these approaches - considerable replication and extension is needed. For example, does the perspective circle affirmation promote health behaviour change in other contexts (e.g., alcohol consumption, fruit and vegetable intake)? Are the largely null findings the result of failure to induce sufficient threat or failure of most self-affirmation approaches in this context? What are the enduring and long-term effects of various approaches? Do these findings hold for less controlled settings? Identifying the most efficacious self-affirmation manipulations and common mechanisms underlying self-affirmation could clarify the utility of self-affirmation for promoting health behaviour change. Regardless of the self-affirmation approach selected, researchers should consider intervention context, time constraints, the integration of appropriate resources, and follow-up assessments to maximize health intervention efficacy.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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DATA AVAILABILITY STATEMENT

Data are available upon request from the corresponding author.

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Statement of contribution

What is already known on this subject?

Self-affirmation can lead to health behaviour change. Different types of self-affirmation manipulations exist, yet there is little, if any, guidance on which techniques are effective for long-term outcomes and whether they affect similar potential mechanisms.

What does this study add?

- In this online test within a sun-protection paradigm, a brief self-affirmation that broadens perspective was most efficacious for promoting sun protection behaviours, including information seeking and spending fewer days outside during peak sun exposure hours.
- Unexpectedly, results were largely null and some well-known self-affirmations, like the values affirmation, did not increase intentions to engage in sun protection, information seeking, or sun protection behaviours.
- Potential mechanisms were variably related to the different self-affirmation approaches and unrelated to health outcomes.

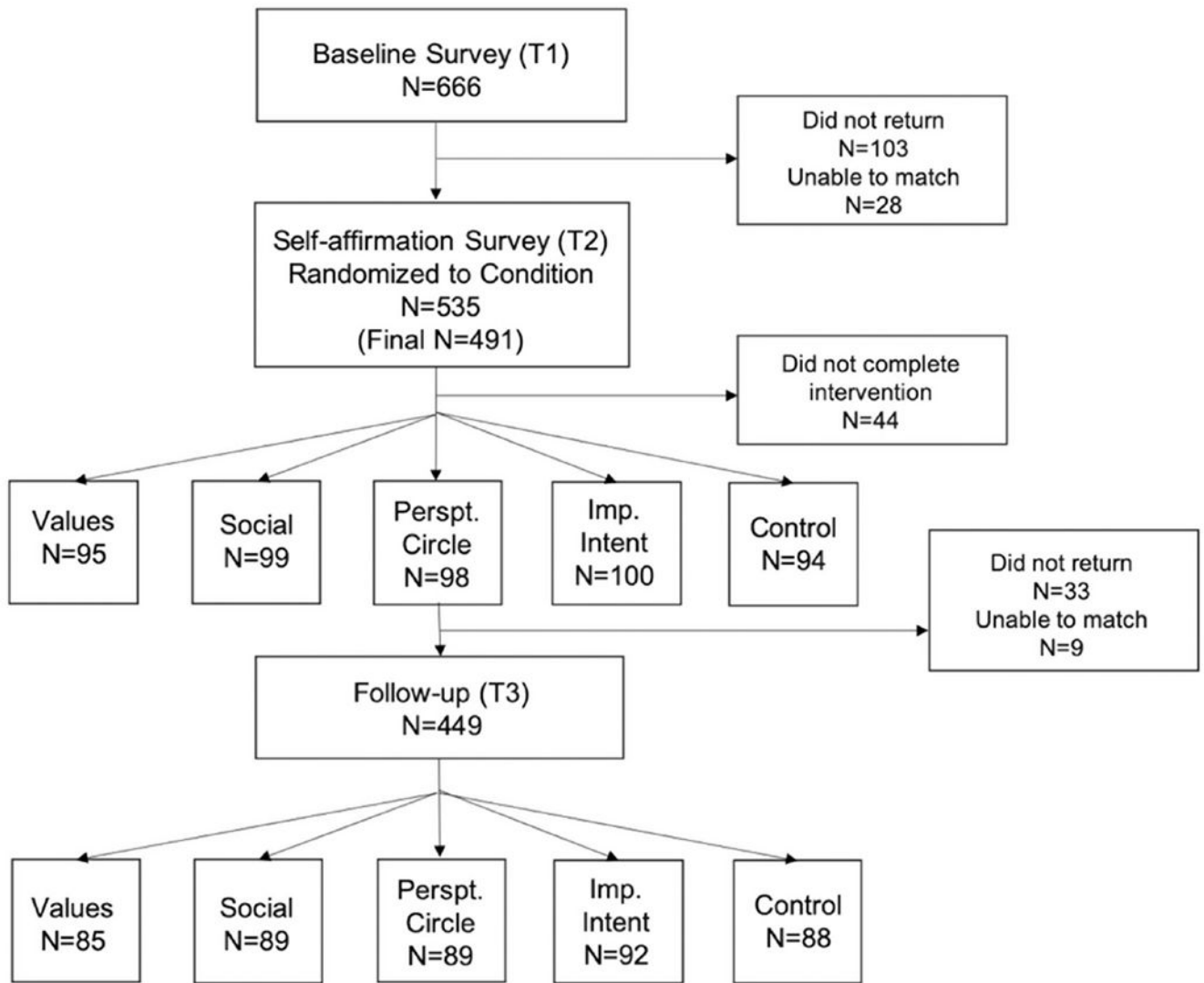


FIGURE 1.
Consort flow.

TABLE 1

Self-affirmation comparison studies on proximal and behavioural outcomes.

Study	Approaches compared	Target behaviour	Proximal outcome change	Behaviour change
Armitage et al. (2011)	Implementation intention, Kindness	Alcohol consumption	Both increased defensiveness	Both decreased alcohol consumption
Celeste et al. (2021)	Values, ^a Dual (Ethnic/British) identity, ^b British identity	Test scores	N/A	Dual-identity affirmation increased scores among Black students, Values affirmation increased scores among non-Black students (primarily Eastern European and South Asian) and <i>decreased</i> scores among Black students
Choi and So (2019)	Values, Message-integrated positive trait	Environmentally conscious action (e.g., recycling)	When viewing a high-threat message, both increased perceived risks, attitude and intention	N/A
Critcher and Dunning (2015)	Values, Perspective	Test scores	Both reduced defensiveness	N/A
Harris et al. (2014)	Values, Implementation intention, and a combination condition	Fruit & vegetable intake	None had an effect on intentions	All increased fruit/vegetable consumption
Iles et al. (2021)	Values essay, Health essay, Other-affirmation essay, ^c Values questionnaire, Health questionnaire, Other-affirmation questionnaire, Kindness questionnaire, Self-activation ^d	Alcohol consumption	Comparisons: <i>Self- vs. Other-affirmations</i> Self-affirmations associated with greater odds of creating an action plan to reduce alcohol consumption <i>Values vs. Health-affirmations</i> Values-affirmations associated with greater odds of creating an action plan to reduce alcohol consumption <i>Essay vs. Questionnaire</i> Essay affirmations associated with more worry and greater intentions to reduce consumption <i>Self-affirmation vs. Self-activation</i> Self-affirmation associated with less endorsement of the message and perceived importance of following health guidelines, but greater intentions to reduce consumption	N/A
Jessop et al. (2009)	Values, Kindness, and Positive trait	Sunscreen use	All led to more positive attitudes	Only positive trait affirmation increased sunscreen acceptance
Jiang (2018)	Values, Work affirmation	Creativity (Slogan Generation)	N/A	Both attenuated the negative effect of high job insecurity on creativity
Knight and Norman (2016)	Values, Kindness, and Positive attributes	Binge drinking	None led to differences in attitudes or intentions	None led to behaviour change
Norman and Wrona-Clarke (2016)	Values, Implementation intention, and a combination condition	Binge drinking	None led to differences in defensiveness or intentions	Implementation intentions reduced binge drinking
Shnabel et al. (2013)	Values, Social belonging	Test scores	N/A	Only social belonging improved test scores
Vogt et al. (2021)	Implementation intention, Kindness questionnaire	Alcohol consumption	Neither led to differences in message acceptance, perceived risks, intentions, or action plans	Neither led to behaviour change
Zhu and Yzer (2021)	Values, Positive attributes	Alcohol consumption	Both reduced defensiveness, increased message acceptance	N/A

Note: Only studies containing multiple self-affirmation interventions, a control, and a threat included.

^a“Values” indicates a values essay affirmation unless otherwise noted.

^bDual-identity affirmation aims to simultaneously affirm both ethnic identity and common national identity among students.

^cOther-affirmation entails thinking of a value important to oneself and how a close other has demonstrated that value.

^dSelf-activation is induced by having participants circle all instances of the letter “i” in a paragraph.

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TABLE 2

Baseline characteristics and follow-up rates across conditions.

Variable	Total (time 2), (<i>N</i> = 486)	Values (<i>N</i> = 95)	Social (<i>N</i> = 99)	Perspective (<i>N</i> = 98)	Imp. Intent (<i>N</i> = 100)	Control (<i>N</i> = 94)	ANOVA or chi-square
Background							
Age	39.68 (11.93)	39.44 (12.07)	38.91 (11.16)	40.62 (13.08)	41.27 (12.78)	38.05 (10.20)	$F(4, 480) = 1.14, p = .34$
Gender (% Female)	52.40	51.60	50.50	50.00	56.00	53.20	$\chi^2(4, N = 485) = .85, p = .93$
Ethnicity (% White)	74.30	76.80	69.70	75.50	77.00	72.30	$\chi^2(4, N = 486) = 2.04, p = .72$
Sun behaviour							
T1 days outside (0–7)	4.13 (2.24)	4.41 (2.23)	4.18 (2.17)	3.53 (2.25)	4.30 (2.27)	4.22 (2.23)	$F(4, 481) = 2.35, p = .054$
T1 sun exposure days (–7, +7)	1.45 (3.05)	1.66 (3.21)	1.66 (2.84)	1.04 (2.76)	1.18 (3.41)	1.73 (2.96)	$F(4, 481) = 1.07, p = .37$
Typicality (0–7)	5.37 (1.33)	5.55 (1.24)	5.25 (1.47)	5.18 (1.34)	5.44 (1.31)	5.44 (1.23)	$F(4, 481) = 2.17, p = .30$
Importance of skin health (1–7)	5.89 (.96)	5.95 (.97)	5.79 (.99)	5.88 (.97)	5.91 (.81)	5.94 (1.04)	$F(4, 481) = .44, p = .78$

Note: Values are means (standard deviation) or proportions.

TABLE 3

Time 2 and Time 3 means and effect sizes for sun exposure outcomes across conditions.

Variable	Control _a (N = 88)	Values _b (N = 85)	<i>d_a</i>	Social (N = 89)	<i>d_a</i>	<i>d_b</i>	Perspect. Circle (N = 89)	<i>d_a</i>	<i>d_b</i>	Imp. Intent (N = 92)	<i>d_a</i>	<i>d_b</i>
<i>Time 2</i>												
Intentions												
Intended days outside next week (0–7)	3.80 (1.97)	3.90 (1.93)	.05	3.87 (2.13)	.03	.01	3.24 (2.22)	.27 [†]	.32	3.83 (2.22)	.01	.03
Intended exposed days outside (–7, +7)	.14 (2.41)	.30 (2.62)	.07	.27 (2.37)	.06	.01	–.37 (2.17)	.22	.28	–.18 (2.63)	.13	.18
Resource engagement												
Dwell time (seconds)	25.37 (27.33)	23.47 (39.75)	.06	27.97 (29.83)	.09	.13	24.83 (23.36)	.02	.04	22.33 (19.38)	.13	.04
<i>Time 3</i>												
Behaviour												
Days outside last week (0–7)	4.02 (2.11)	3.74 (2.00)	.14	3.94 (2.11)	.04	.10	3.30 (1.98)	.35 [*]	.22	3.90 (2.05)	.06	.08
Exposed days outside last week (–7, +7)	1.07 (2.43)	1.10 (2.04)	.01	.71 (1.93)	.16	.20	.56 (1.44)	.25	.31	.73 (2.69)	.13	.15
Intentions												
Intended days outside next week (0–7)	3.85 (1.97)	3.68 (2.11)	.08	3.99 (2.29)	.07	.14	3.50 (2.12)	.17	.09	4.10 (2.08)	.12	.20
Intended exposed days outside (–7, +7)	.40 (2.68)	.24 (2.22)	.07	.48 (2.14)	.04	.11	.07 (1.96)	.14	.08	.36 (2.64)	.01	.05
Resource engagement												
Dwell time (seconds)	45.34 (34.57)	45.20 (35.00)	.003	51.40 (41.60)	.16	.16	64.84 (80.72)	.31 [*]	.32	48.82 (68.33)	.06	.07
Link follows (% any follows)	2.3	7.3	–	13.5	–	–	17.4	–	–	7.8	–	–

Note: Values are Means (standard deviation) or proportions, *d* is Cohen's *d* effect size: *d_a* compares each self-affirmation condition to the control, *d_b* compares values affirmation to all other self-affirmations.

* indicates a significant $p < .05$

[†] Indicates $p < .10$ for planned comparisons.

TABLE 4

Logistic regressions of link follows by condition with control and values contrasts.

Predictor	β	SE β	Wald's X^2	df	p	e^{β} (odds ratio)
Control vs. all affirmation conditions						
Constant	-3.75	.72	27.47	1	<.001	-
Values affirmation	1.21	.83	2.12	1	.145	3.36
Social affirmation						
	1.89	.78	5.88	1	.015	6.62
Perspective circle	2.20	.77	8.13	1	.004	8.98
Imp. Intention	1.28	.82	2.44	1	.118	3.58
Values vs. other self-affirmation conditions						
Constant	-2.54	.42	35.85	1	<.001	-
Social affirmation	.68	.53	1.68	1	.196	1.97
Perspective circle	.98	.51	3.72	1	.054	2.68
Imp. intention	.07	.58	.01	1	.909	.08
Test						
			X^2	df	p	Nagelkerke R^2
Control vs. all affirmation conditions						
Overall model evaluation						
Likelihood ratio test			14.80	4	.005	.071
Score test			13.72	4	.008	
Values vs. other self-affirmation conditions						
Overall model evaluation						
Likelihood ratio test			5.91	3	.116	.033
Score test			5.95	3	.114	

Note: Significant condition effects are bolded.

TABLE 5

Time 2 means and effect sizes for putative intervention mechanisms across conditions.

Variable	Control (<i>N</i> = 94)	Values (<i>N</i> = 95)	<i>d</i>	Social (<i>N</i> = 99)	<i>d</i>	Perspective circle (<i>N</i> = 98)	<i>d</i>	Imp. Intent (<i>N</i> = 100)	<i>d</i>
Defensiveness (1–7)	2.95 (1.38)	2.93 (1.68)	.009	2.91 (1.43)	.03	2.84 (1.49)	.07	2.92 (1.56)	.02
Positive self-worth (1–9)	5.93 (1.97)	6.63 (1.84)	.37*	6.01 (1.67)	.04	6.34 (1.60)	.23	6.07 (1.94)	.07
Negative self-worth (1–9)	3.43 (2.05)	2.59 (1.95)	.42*	2.88 (1.65)	.30*	2.82 (1.77)	.31*	3.19 (2.04)	.11
Narrow self-assessment (1–9)	6.48 (2.06)	7.24 (1.67)	.41*	6.72 (1.56)	.13	6.89 (1.41)	.23 [†]	6.72 (1.70)	.13

Note: Values are Means (standard deviation). Cohen's *d* compares each self-affirmation condition to the control.

* indicates $p < .05$.

[†] Indicates $p < .10$ for planned comparisons. Control is referent condition.

TABLE 6

Correlations between putative mechanisms, sun outcomes & personal characteristics.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
1. Self-esteem	–														
2. Narrow self-assessment	.50*	–													
3. Positive self-worth	.67*	.67*	–												
4. Negative self-worth	-.56*	-.44*	-.63*	–											
5. Defensiveness	-.12	-.15*	-.10	.32*	–										
6. T1 Exposure Days	-.03	-.10	-.10	.00	.01	–									
7. T2 Exposure Intent	-.03	-.11	-.07	-.02	.04	.51*	–								
8. T3 Exposure Days	-.01	-.09	-.07	.00	-.03	.55*	.57*	–							
9. T3 Exposure Intent	-.08	-.13*	-.08	.04	.01	.48*	.61*	.70*	–						
10. T2 Resource Time	.02	.02	-.01	-.03	-.04	.02	.03	.02	-.04	–					
11. T3 Resource Time	.05	.09	.06	-.08	-.10	-.06	-.08	-.03	-.07	.18*	–				
12. Age	.27*	.20*	.17*	-.18*	.05	.02	-.01	-.02	-.01	.08	.19*	–			
13. Latitude	-.11	-.10	-.06	.03	.11	-.07	.06	-.11	.00	-.03	-.05	-.01	–		
14. Typicality	.09	.09	.08	-.08	-.05	.04	-.01	.05	.03	.10	-.07	.01	-.09	–	
15. Importance	.27*	.32*	.27*	-.19*	-.22*	-.11	.18*	-.12*	-.17*	.10	.13*	.16*	-.10	.04	–

Note: Significant effects $p < .01$ are starred.